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HEADQUARTERS AIR FORCE CIVIL ENGINEERING SUPPORT AGENCY
TYNDALL AIR FORCE BASE FL 32403-6001

REPLY TO HQ AFCESA/EN
ATTN OF: 139 Barnes Drive, Suite 1 13 JUL 1993
Tyndall AFB Fl 32403-5319

SUBJECT: Engineering Technical Letter (ETL) 93-2:
Dormitory Criteria for Humid Areas

TO: Distribution List

1. Purpose. This letter provides the design criteria to ensure control of humidity inside dormitories in humid areas. Areas not covered by this ETL remain in accordance with existing guidance.

2. Application. This ETL applies to the design of new or renovated dormitories at Air Force bases in humid areas as described below that are not 35 percent designed. Ultimate recipients of this ETL are MAJCOMs, bases, and Air Force design and construction agents responsible for facilities in humid areas.

3. Specific Requirements.

3.1. Introduction. Existing criteria for Air Force dormitory facilities do not control interior space humidity successfully when applied in humid areas. For the purpose of this ETL, humid areas are defined as having over 3000 hours of 67 deg. F or higher wet bulb temperature in combination with an outside design condition of 50 percent relative humidity or higher, or over 1500 hours of 73 deg. F or higher wet bulb temperature in combination with an outside design condition of 50 percent relative humidity or higher, based on 2.5 percent dry bulb and 5 percent wet bulb temperatures. The high ambient moisture and temperature common in high humidity areas reverse vapor flow through building components and increase the latent cooling load on HVAC equipment when compared to the design conditions for most other CONUS locations. These unique conditions require design criteria different than that of the conventional wisdom used in other areas.

3.2. Building Envelope. The building envelope design shall:

3.2.1. Place the least permeable material or vapor retarder on the exterior side of the building insulation and place more permeable materials inside the building insulation.

3.2.2. Provide interior surfaces of exterior walls that will allow water vapor within the wall to escape into the conditioned space. Vinyl wallcoverings, multiple coats of oil-based paint, and other vapor-resistant materials will not be used as interior finishes of exterior walls.

3.2.3. For double wythe walls, place the vapor retarder on the exterior side of the inner wythe.

3.2.4. Analyze the vapor flow through the building insulation systems, wall sections, and roof/ceiling sections. The variety of roof/ceiling systems available to the designer and the concepts for attic ventilation prevent definitive requirements from being established; however, roof/ceiling/ insulation systems will reflect the following principles:

3.2.4.1. Place the vapor retarder exterior to the insulation. In some cases, the roof membrane may serve as the vapor retarder.

3.2.4.2. Ventilate spaces created exterior to the roof/ceiling vapor retarder.

3.2.4.3. Prohibit outside air entry into spaces created interior of the thermal envelope formed by the roof/ceiling insulation. Ventilation of such spaces, if required, must use air from conditioned spaces.

3.2.5. Seal all openings: around doors and windows, lintels, utility penetrations, seams in vapor retarders and air barriers, intersections of walls and roofs, etc. Provide details of vapor barrier treatments for these conditions.

3.2.6. Ensure that moisture transfer from ventilated attics into the building is minimized the same as walls.

3.2.7. Provide details to minimize thermal bridging, especially at door and window frames and the intersections of walls and roofs.

3.2.8. Provide sufficient floor-to-floor height, vertical distribution space, and mechanical equipment space to accommodate a ducted all-air HVAC system.

3.3. Mechanical Systems.

3.3.1. New Facilities. New facilities shall employ central station air handling units (AHUs) that supply conditioned air to variable air volume (VAV) terminal units with integral heating coils. VAV terminal units shall be the air throttling type consisting of a pressure-independent air valve which is modulated in response to space temperature. Fan-powered terminal units shall not be used. Fan coil unit air conditioning equipment shall not be used.

3.3.2. Existing Facilities. Existing facilities to be renovated shall incorporate VAV systems as described for new facilities in 3.3.1. above.

3.3.3. General Requirements.

3.3.3.1. Terminal Heating. Terminal heating shall be applied locally at the conditioned space. The terminal heating design shall utilize recovered heat in accordance with ASHRAE STD 90.1 for reheat and other simultaneous heating and cooling.

3.3.3.2. Reheat. Air-conditioning systems in less humid geographical areas normally distribute cooling air at 55 deg. F to 60 deg.F. In humid areas, lower cooling coil discharge air temperatures are required to provide necessary latent cooling capacity and offset moisture gains through the building envelope. This lower coil discharge temperature may require the use of a reheat coil downstream of the AHU to bring supply air temperatures in line with normal practice and ensure that the exterior surfaces of the ductwork remain above.the dew point temperature of the building ambient air. The application of this reheat coil, if used, will be in accordance with ASHRAE STD 90.1 for reheat and other simultaneous heating and cooling. Access sections shall be provided between the fan and the reheat coil.

3.3.3.3. Heat Recovery. Condenser heat recovery will be utilized for terminal heating coils in the VAV units and the reheat coil. Use of condenser heat recovery for reducing the domestic hot water load will also be considered.

3.3.3.4. Preheat. Some humid area applications may require tempering or preheating the minimum outside air to prevent freezing and/or nuisance trips of the freeze protection devices. The designer shall determine the winter design mixed-air temperature resulting from mixing the minimum outside air quantity at the winter outside air design temperature and the return air at its expected condition. If necessary, provide the central AHU with a preheat-only coil located in the outside air duct to temper the winter supply air for the VAV system. Provide preheat control to maintain a constant mixed-air temperature.

3.3.3.5. Heating. Provide an appropriately-sized heating source to meet heating requirements and back up the sources of recovered heat.

3.3.3.6. Controls. Provide control strategies as specified in Army Technical Manual TM 5-815-3, Heating, Ventilating, and Air-conditioning (HVAC) Control Systems, except as indicated below.

3.3.3.6.1. Space heating for VAV systems shall use VAV terminal units with integral heating coils. Control shall be proportional type by the variable air terminal controller in response to a room thermostat. The heating coil control valve shall modulate open after the primary air supply to the space is at minimum setting. Deadband type thermostats will not be used in Air Force construction.

3.3.3.6.2. Cooling/dehumidification shall be accomplished by cooling coils in the AHUS. Control shall be constant leaving air temperature. Determine the leaving air set point by an engineering analysis. Leaving air set point shall not exceed 55 F.

3.3.3.6.3. Economizer cycle will not be used in Air Force construction.

3.3.3.7. Ventilation Air. Minimum outside air quantities shall comply with ASHRAE STD 62 or as required for building pressurization, whichever is larger. Positive pressure shall be maintained to reduce infiltration. Ventilation air shall be 110 percent to 120 percent of exhaust air for all spaces with direct mechanical exhaust.

3.3.3.8. Exhaust System. A central ducted exhaust system shall be used in lieu of individual exhaust fans for each space. The exhaust system shall run continuously and be interlocked with the building supply air system. The exhaust duct for each space shall have a manual volume damper accessible from the space for proper balancing.

3.3.3.9. Air Path. Return air shall be ducted. Closet and storage spaces shall have louvered doors, and return air shall be drawn through these spaces. In the event there no closets or storage spaces, the return air shall be drawn through the utility area between the living space and the bathroom.

3.3.3.10. Equipment Selection.

3.3.3.10.1. Cooling coil fin density shall be indicated on equipment schedules at 8 fins/inch maximum to ensure a cleanable coil and competitive bidding. Face velocities shall not exceed 550 ft/min to preclude moisture carryover.

3.3.3.10.2. The minimum number of cooling coil rows shall be specified in the equipment schedules. The number of rows shall be based on a comparison of data from at least three manufacturers and ensure that latent cooling loads can be met or exceeded.

3.3.3.10.3. Cooling coil entering and leaving air conditions shall be specified (wet and dry bulb temperatures) at the maximum airflow rate.

3.3.3.11. System Layout.

3.3.3.11.1. To the maximum extent possible, chilled water piping shall not be concealed in walls or ceilings of occupied spaces.

3.3.3.11.2. Insulate chilled water piping with cellular glass type insulation with an exterior vapor barrier.

3.3.3.11.3. Access panels, sufficiently sized, shall be located for maintenance of VAV boxes, dampers, controls, and associated components.

4. Commissioning. Dormitory HVAC systems will be commissioned to verify and document actual performance of the HVAC systems and evaluate conformity with the design intent. Air Force ETL 90-9, Commissioning of Heating, Ventilating, and Air Conditioning (HVAC) Systems, or Corps of Engineers Guide Specification, CEGS 15995, Commissioning of HVAC Systems, will be used to develop the contract requirements for commissioning.

DENNIS M. FIRMAN, PE
Director of Systems Engineering

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2. ETL Index

ENGINEERING TECHNICAL LETTERS (ETL)

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82-2	Energy Efficient Equipment	10 Nov 82
83-1	Design of Control Systems for HVAC	16 Feb 83
	Change No. 1 ETL 83-1, U.S. Air Force Standardized Heating, Ventilating & Air Conditioning (HVAC) Control Systems	22 Jul 87
83-3	Interior Wiring Systems, AFM 88-15 Para 7-3	2 Mar 83
83-4	EMCS Data Transmission Media (DTM) Considerations	3 Apr 83
83-7	Plumbing, AFM 88-8, Chapter 4	30 Aug 83
83-8	Use of Air-to-Air Unitary Heat Pumps	15 Sep 83
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84-2	Computer Energy Analysis	27 Mar 84
	Change 1 Ref: HQ USAF/LEEEU Msg 031600Z MAY 84	1 Jun 84
84-7	MCP Energy Conservation Investment Program (ECIP)	13 Jun 84
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90-3	TEMPEST Protection for Facilities Change 1 Ref: HQ USAF/LEEDE Ltr dated 20 April 90, Same Subject	20 Apr 90
90-4	1990 Energy Prices and Discount Factors for Life-Cycle Cost Analysis	24 May 90
90-5	Fuel and Lube Oil Bulk Storage Capacity for Emergency Generators	26 Jul 90
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93-2	Dormitory Criteria for Humid Areas	13 Jul 93

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89-5		Issued as ETL 90-7
91-8	24 Sep 91	Canceled

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